ONDRAF/NIRAS

Novel binders as waste form matrix.

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ONDRAF-NIRAS

the Belgian National Agency for Radioactive Waste and Enriched Fissile Materials

Waste Acceptance Criteria for conditioned waste:

- ACRIA-HEC- ...

  Waste that is covered with a cementitious matrix; e.g. filters

- ACRIA-HOC- ...

  Waste that is intermixed with a cementitious matrix; e.g. concentrates

Heterogenous conditioned waste

e.g.: filters, pumps, cables, ...

ACRIA HEC...

Does not allow novel binders, only binder according to EN 197-1

EN 197-1: Cement Part 1: Composition, specifications and conformity criteria for common cements.

Portland and related cements (e.g. blastfurnace cement).

Homogenous cemented waste

e.g.: cemented resins, concentrates, …

ACRIA-HOC… states (translated):

The binder has to

1. Either, respect the standard EN 197-1;
2. Or, is a sulfoalumnium-cement, phosphormagnesium-cement, a geopolymer or alkali-activated slag.

In case n°2 is applied, with the exception of alkali-activated slag, the compatibility of the following is to be demonstrated:

- Compatibility between porewater of the novel binder matrix and a classic concrete matrix;
- Compatibility between porewater of a classic concrete and the novel binder matrix.

This compatibility should be demonstrated by tests.

Homogenous cemented waste

e.g.: cemented resins, concentrates, ...

ACRIA-HOC... states (translated):

geopolymer = alkali-activated metakaolin

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Homogenous cemented waste

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ACRIA-HOC...

Next to the specific criteria on novel binders, general criteria exist, a.o.:

- Compressive and bending strength: R_c ≥8MPa ; R_f ≥1MPa (on 4x4x16 cm^3 - specimen);
- Durability: microstructural assessment after ≥ 1 year @ 38°C and 100% R.H. during;
- Resistance to water: absence of str. changes & R_f ≥1MPa after 90 days @ 20°C in water;
- Resistance to cold: absence of str. changes & R_f ≥1MPa after 120 days @ 0°C – 10°C in a closed bag;
- Resistance to high temperatures: If temperature > 60°C, then additional testing should exclude additional swelling in humid conditions;
  - Two groups of specimen: one with thermal load (B); one without (A);
  - Both sets stored in water during 12 months and expansion is measured;
  - At 12 months 95% P.I. of the difference between group A and B (A-B) ≥ 0.
- Resistance to irradiation: In case the integrated dose (during 1000y) > 10^7 Gy, all the above is to be tested on irradiated samples.

Conclusion

Novel binders are allowed under conditions

The following novel binders

- sulfoalumnium-cement,
- phosphormagnesium-cement,
- geopolymers or
- alkali-activated slag

are allowed only for homogenous conditioned wastes as long as their compatibility with classic cementitious materials is demonstrated by tests and as long as they are in agreement with the general WAC.